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ORIGINAL RESEARCH

Investigation of Sleep Disorders and Related Influencing Factors Among the Elderly in Southeast Coastal Regions of China: A Cross-Sectional Survey Analysis

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Objective: To assess the sleep status and prevalence rate of the elderly in southeast coastal areas of China, and analyze related factors.

Methods: A questionnaire survey was conducted among elderly individuals in Wenzhou City, Zhejiang Province, situated in the southeast coastal areas of China, using a multi-stage random sampling method. A total of 903 elderly people aged ≥ 60 years were selected for the survey. The questionnaire aimed to assess their sleep status using PSQI and to evaluate related factors using Self-designed General Information and Health Behavior Questionnaires, SAS, GDS-15, ESS, AD8, SHAP, WHOQOL-BREF, among other tools. Logistic regression was applied to analyze the influencing factors of sleep disorders.

Results: Among the 903 elderly individuals who participated in the survey, 316 cases (35.0%) had a PSQI score > 7. Females exhibited a higher prevalence rate of poor subjective sleep quality (24.9% vs 17.6%) and difficulty falling asleep (32.8% vs 22.5%) compared to males. Drinking green tea (OR = 0.1.841, 95% CI, 1.220–2.777, P <0.05) had the strongest association with poor sleep. The duration of nap time ranging from 30 to 90 minutes (OR = 0.492, 95% CI= 0.340–0.713, P < 0.001) and specifically a 90-minute nap (OR = 0.441, 95% CI = 0.234–0.832, P < 0.05) were both significantly associated with a decreased risk of experiencing poor sleep quality.

Conclusion: The prevalence in this population is 35%. Several factors contribute to this prevalence, including tea consumption, anxiety, daytime sleepiness, cognitive decline, environmental influences, awareness of sleep health, knowledge about sleep, and detrimental habits. Specifically, the consumption of green tea negatively impacts sleep quality, while taking naps longer than 30 minutes is associated with a reduced risk of poor sleep. These findings can inform the development of targeted preventive strategies and interventions aimed at mitigating sleep disorders in the elderly population.

Keywords: elderly, sleep disorders, related factors, Pittsburgh Sleep Quality Index, cross-sectional study

Introduction

The Bulletin of the Seventh National Population Census of China in 2021 revealed that there were 260 million elderly individuals aged 60 years and older, constituting 18.70% of the total population, indicating a significant aging trend in China.[1] International epidemiological studies have indicated that over half of the elderly population experiences sleep problems.[2] Similarly, a meta-analysis conducted by Yun et al found that the prevalence rate of sleep disorders among the elderly in China was as high as 47.2%.[3] Sleep problems in the elderly, whether related to insomnia symptoms or excessive sleepiness, can significantly impact their well-being. These symptoms not only cause discomfort for the elderly but also signify a diminished quality of life. Poor sleep quality is associated with an increased risk of mortality in middle-

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aged and older adults.[4] A study suggested that certain sociodemographic characteristics and lifestyles may influence the sleep quality of the elderly.[5]

Sleep disturbance is one of the major risk factors for suicide in the elderly.[6] Sleep problems have been associated with various adverse outcomes, including self-reported poor health status, cognitive decline, anxiety, depression, impairments in basic activities of daily living, chronic diseases, and poverty.[7] A study suggested that certain sociodemographic characteristics and lifestyles may influence the sleep quality of the elderly.[8]

Increasing evidence suggests that napping is common in older adults.[9] Studies have shown that naps increase the 24-hour sleep duration, and there is little evidence that naps are harmful to nighttime sleep in older people, and that daytime naps can serve as a solution to improve their health and daily performance.[10] But excessive daytime napping and Alzheimer's dementia may have a bidirectional relationship.[11] Eating caffeine drinks such as tea can affect sleep quality.[12] Tea drinking, poor sleep environment and other risk factors for the high prevalence of sleep disorders in the elderly.[13] Studies have reported that the prevalence of excessive daytime sleepiness (EDS) among the elderly in rural China is 9.3%, and it is associated with poor sleep quality.[14]

Southeast coastal cities in China have developed economy and densely populated population. At the end of 2018, there were 1,511,400 elderly people over 60 years old in Wenzhou, accounting for 18.23% of the total population. By 2020, the population aged 60 and above has risen to 1.5797 million. Aging, the high incidence of sleep disorders, become an important factor affecting the elderly quality of life, brought a big burden to family and society, an urgent need for sleep problems prevention and intervention measures, and the lack of for the elderly sleep health and related factors of detailed research to provide reference basis.

However, there has been a lack of epidemiological surveys on sleep disorders among the elderly in the Southeast Coastal Areas of China. Therefore, this study aimed to survey the status of sleep disorders among the elderly in this region from multiple perspectives, including demographics, health behaviors, health status, sleep hygiene awareness and practices, and QoL, to further analyze the influencing factors of sleep disorders in this population. The goal of the study is to provide a scientific basis for the prevention and treatment of sleep disorders among the elderly.

Objects and Methods

Study Objects

From July to December 2017, an interview questionnaire survey was conducted among elderly residents in Wenzhou City, Zhejiang Province. Additionally, a multi-stage random sampling survey was carried out among individuals aged above 60 years in Lucheng District, Longwan District, and Ouhai District. To accomplish this, one township/sub-district was randomly chosen from each district as the study site. Subsequently, three communities/villages were randomly selected from each of the three townships/sub-districts identified previously. Finally, all elderly individuals meeting the conditions from the nine selected communities/villages were considered as the theoretical samples. Criteria for inclusion: (1) Aged $\geq$ 60 years old; (2) Being conscious enough to have basic communication with investigators; (3) Participating in the survey out of their own will. Criteria for exclusion: (1) Those with obvious cognitive impairment and severe mental illness; (2) Those with poor compliance.

The data collectors in this study were a fixed survey team consisting of five uniformly trained personnel containing two psychiatrists with more than attending staff. Prior to administering the questionnaire, members of the survey team detailed the purpose, consistency, confidentiality, benefits, and risks. The minimum sample size required for this study was calculated by the sample size formula, $N = KQ / P$, $Q=1-P$, test level $\alpha =0.05$ (one-sided) test efficacy $1- \beta =0.90$, according to the survey of elderly sleep disorders in other regions of China combined with literature survey, the prevalence of sleep disorders was 40% (P=40%), the allowable error was 10%, K=400, and the shedding rate was 20%. The required sample size was 720 individuals. A total of 1130 older adults were recruited to achieve more reliability. Out of the total 1130 elderly individuals who met the criteria, 1005 (89%) were enrolled in the study. However, 102 of these were excluded due to a lack of data on sleep and other variables. Consequently, the remaining 903 individuals were retained for the current analysis of sleep disorders. This study received approval from the Ethics Committee of Wenzhou Seventh People's Hospital, and all surveyed subjects provided informed consent prior to participation.

Measurements

A structured questionnaire survey was administered through interviews conducted by systematically trained full-time medical staff. The survey covered various sociodemographic factors (such as gender, age, years of education, marital status), health behavior factors (including smoking, alcohol consumption, tea consumption, exercise, afternoon napping (Nap duration, nap Frequency), health status factors (comprising chronic diseases, anxiety and depression status, sleepiness status, cognitive status), sleep hygiene awareness and practice factors, as well as QoL factors, among others. The types of tea consumed include green tea, black tea, more than two types of tea or other types of tea.

However, the history of chronic diseases (eg, hypertension, diabetes mellitus, hyperlipidemia, coronary heart disease, cerebrovascular disease, Parkinson's disease, malignant tumors, renal insufficiency, chronic obstructive pulmonary disease, etc). was determined by professional physicians in Level II or above hospitals. Smoking and alcohol consumption statuses were categorized as current use or non-current use (never or quit). Marital status was classified as married or unmarried (including single, divorced, and widowed). Afternoon napping status was determined by whether there had been an afternoon nap in the recent two years. The term "naps" in this context specifically refers to post-lunch naps taken consistently over a nearly two-year period. The variables examined in this study include the duration of each daily nap and the frequency of naps taken per week. Exercising for 20 minutes or more per day was considered as engaging in exercise.

Pittsburgh Sleep Quality Index (PSQI)

Sleep quality was evaluated using the PSQI.[15] The PSQI comprised 19 items, assessing seven sleep domains: subjective sleep quality, sleep duration, sleep efficiency, sleep disorders, use of hypnotics, and daytime dysfunction. Each subdomain of sleep disorders was rated on a scale of 0 to 3, with a score of ≥ 2 indicating abnormal sleep. The scores of all items were added to calculate the total PSQI score, which ranged from 0 to 21. A higher total score indicated poorer sleep quality. In this study, sleep disorders were defined as a total PSQI score > 7, while the absence of sleep disorders was defined as a total PSQI score ≤ 7.

Sleep Hygiene Awareness and Practice (SHAP)

The SHAP scale was employed to evaluate whether patients' exercise habits were beneficial, harmful, or ineffective for their sleep.[16] Additionally, this scale assessed the extent to which sleep was disrupted by environmental factors and adverse sleep-related behaviors of the patients. Each item was rated on a scale of 0–7. The validity and reliability of this scale were tested in both general and clinical populations in China and were found to be good.[17–19] The sleep hygiene knowledge section consisted of 13 items, with a total score ranging from 13 to 39. A higher score indicated less scientific knowledge of sleep hygiene. In the current study, the Cronbach's alpha value was 0.813.

The sleep hygiene practice section comprised 19 items, with a total score ranging from 0 to 133. A higher score indicated less healthy sleep hygiene practices. In the current study, the Cronbach's alpha value was 0.834.

The World Health Organization Quality of Life-BREF (WHOQOL-BREF)

This scale encompassed four aspects: psychological domain, physiological domain, social domain, and environmental domain, comprising a total of 26 items.[20] Each item was rated on a 5-level scale, with higher scores indicating better quality of life for the patients.

15-Item Geriatric Depression Scale (GDS-15)

The 15-item Geriatric Depression Scale (GDS-15) was utilized to assess the degree of depression among the subjects.[21] It consisted of totally 15 items, with scores ranging from 0–15. A higher score indicated a more severe level of depression.

Self-Rating Anxiety Scale (SAS)

The Self-rating Anxiety Scale (SAS) was employed to evaluate the degree of anxiety among the patients.[22] A total SAS score > 50 indicated the presence of anxiety, with higher scores indicating severe anxiety levels.

Alzheimer's Disease - 8 (AD8)

AD8 is a cognitive impairment screening tool, and the validity of its Chinese version has been verified.[23] Eight items were utilized to assess changes in patients resulting from cognitive problems. A score of AD8 ≥ 2 was considered the threshold for suspected cognitive dysfunction.

Epworth Sleepiness Scale (ESS)

The Epworth Sleepiness Scale (ESS) primarily assessed the daytime sleepiness status of the subjects.[24] This questionnaire recorded the likelihood of the subjects taking a nap under eight different circumstances, with each item scored from 0–3. A higher score indicated more severe sleepiness. ESS ≥ 9 indicated a relatively high risk of excessive daytime sleepiness.

Statistical Analysis

The database was established using Epidata 3.1, with data entry double-checked for accuracy. Data analysis was conducted using SPSS 26.0 statistical software. Counting data were presented as the number of cases and percentage, and inter-group comparisons were performed using the Chi-square test. Measurement data were expressed as (x ± s) or [M(Q1,Q3)], and inter-group comparisons were carried out using the *t*-test or non-parametric test of two independent samples. A binary logistics regression model was employed to assess the impact of different factors on sleep disorders, with variable screening conducted using a stepwise backwards method. A significance level of P ≤ 0.05 was considered statistically significant.

Results

General Sociodemographic Characteristics of the Study Population

The average age of the 903 subjects was 73.61 ± 9.228 years. Among them, there were 284 males and 619 females (accounting for 68.5%). The elderly in this area exhibited a relatively low level of literacy, with an average of 3.83 ± 4.186 years of education, and most had attained only a primary education degree or were illiterate. A total of 559 were married, while the unmarried accounted for 38.1%. There were 115 smokers, comprising 12.7% of the population; 204 alcohol drinkers, accounting for 22.6%. There were 689 non-tea drinkers, accounting for 76.3%; 164 green tea drinkers, accounting for 18.2%; 15 black tea drinkers, accounting for 1.7%; and 35 people who drank two kinds of tea or more, accounting for 3.8%. 518 engaged in regular exercise, accounting for 57.4%. There were two variables describing the nap, namely, the nap time and the nap frequency. The nap time was divided into 4 groups,:NO nap:406, accounting for 45.0%; Nap duration ≤30min: 124, accounting for 13.7%; Nap duration, 30–90min: 299, accounting for 33.1%; Nap duration ≥90min: 74, accounting for 8.2%. Nap frequency was divided into 3 groups, No nap:406; Nap frequency≤1-3/week:171; Nap frequency≥4-6/week:326. Chronic diseases were highly prevalent among the elderly in this area (71.2%). The total prevalence rate of sleep disorders among the study population was 35.0%, with a higher rate observed in females compared to males (37.6% vs 29.2%, p<0.05).

Statistical differences were observed in inter-group comparisons of gender, age, years of education, current smoking, exercise, Nap duration and chronic disease ($p < 0.05$) regarding sleep disorders. Comparisons between the elderly with and without sleep disorders also revealed statistical differences in total SAS, GDS, ESS, AD8, and WHOQOL (BREF) scores, as well as in the physiological domain, psychological domain, and score of sleep hygiene practice ($P < 0.001$). Additionally, there were differences in the total score of sleep hygiene awareness, social domain, and environmental domain ($p < 0.05$), as presented in Table 1.

Distribution of Sleep Disorders in Each Sub-Domain

The prevalence of the PSQI's problematic sleep subdomain by gender is displayed in Table 2. A total of 29.7% of respondents reported having trouble falling asleep, 27.5% reported abnormal sleep duration, 38.8% reported reduced sleep efficiency, 21.0% reported dysfunction during the day, 17.1% reported sleep disorders, 18.0% reported poor subjective sleep quality, and 5.8% reported using hypnotics. There was a statistically significant difference in the inter-

Table 1 Attributes of Sleep Disorders Among the Research Participants (n=903)

Characteristics	Total Number	No	Yes	X^2 /Z	P-value
Number of subjects	903	587(65.0)	316(35.0)		
Male	284(31.5%)	201(34.2)		6.062	0.014*
Age	903	73(66,80)			0.059
Years of education	903	3.00(0, 7)			0.039*
Marital status (married)	559	373(63.5)			0.167
Smoking	115(12.7)	85(14.5)			0.032*
Drinking alcohol	204(22.6)	142(24.2)			0.117
NO Drinking tea	689	453(77.2)	236(74.7)	7.528	0.057
Green tea	164	95(16.2)	69(21.8)		
Black tea	15	12(2.0)	3(0.9)		
Drink more than two teas or others	35	27(4.6)	8(2.5)		
Exercise	518(57.4)	338(57.6)			0.858
Chronic disease	643(71.2)	405(69.0)			0.045*
Total SAS scores	903	35(34,36)			0.000***
Total GDS scores	903	10(8,10)			0.000***
Total ESS scores	903	4(0,8)			0.000***
Total AD8 scores	903	1(0,3)			0.000***
Total SleepHygiene Awareness scores (SHAP)	903	21(14,28)			0.000***
Total score of sleep hygiene practice (SHAP)	903	54(52,58)			0.014*
Total QOL-BREF scores	903	57(53,61)			0.000***
Physiological domain	903	14(13,15)			0.000***
Psychological domain	903	14(13,15)			0.000***
Social domain	903	14(12,16)			0.002**
Environmental domain	903	14(13, 15)			0.110
Afternoon nap (in recent two years)	479(53.0)	323(55.0)			0.104
Nap duration (minutes/day)	903				
No nap	406	254(43.3)	152(48.1)	7.849	0.049*
≤30min	124	72(12.3)	52(16.5)		
30–90min	299	208(35.4)	91(28.8)		
≥90min	74	53(9.0)	21(6.6)		
Nap Frequency (times/day)	903				
No nap	406	256(43.6)	150(47.5)	5.065	0.079
1–3 times per week	171	104(17.7)	67(21.2)		
4–6 times per week	326	227(38.7)	99(31.3)		

Notes: Unless otherwise stated, the data is n (%). *P< 0.05, **P< 0.01, ***P< 0. 001.

Abbreviations: SAS, Self-rating Anxiety Scale; GDS-15, 15-item Geriatric Depression Scale; ESS, Epworth Sleepiness Scale; AD8, As—dementia 8 Questionnaire;SHAP, SleepHygiene Awareness and Practice,It includes:SleepHygiene Awareness,SleepHygiene Practice; WHOQOL-BREF, the World Health Organization Quality of Life–BREF, It includes: physiological domain, psychological domain, society domain, environmental domain.

Table 2 Stratified PSQI Abnormal Sleep Subdomains by Gender

Distribution of PSQI subdomains*, N (%)								
Gender	**Number**	**Subjective Sleep Quality**	**Difficulty Falling Asleep**	**Sleep Duration**	**Sleep Efficiency**	**Sleep Disorder**	**Use of Hypnotic**	**Daytime Dysfunction**
Total number	903	204(18.0)	267(29.6)	248(27.5)	350(38.8)	154(17.1)	52(5.8)	190(21.0)
Gender								
Male	284	50(17.6)	64(22.5)	73(25.7)	106(37.3)	39(13.7)	15(5.3)	54(19.0)
Female	619	154(24.9)						136(22.0)
P-value		0.015	0.002	0.422		0.072		0.311
X^2		5.889						1.024

Note: *Each subdomain is measured on a 0–3 scale, with a score of ≥ 2 indicating abnormal sleep subdomains.

group comparison (P < 0.05) in the incidence rates of poor subjective sleep quality and trouble falling asleep in all subdomains of sleep disorders between males and females.

Related Factors of Sleep Disorders

Table 3 displays the associations between various sociodemographic variables, health behavior variables, health status variables, awareness and practice of good sleep hygiene, quality of life variables and sleep disorders. Binary logistics regression analysis was performed using the stepwise backwards method, with the presence or absence of sleep disorders as the dependent variable and the aforementioned related factors as the independent variable. Input variables: gender, age, years of education, marriage, chronic diseases, smoking history, drinking history, tea drinking history, exercise (each exercise for 20 minutes or more), SAS total score, GDS total score, ESS total score, AD8 total score, physiological total score QOL-BREF, psychological total score QOL-BREF, social relations field total score QOL-BREF, environmental total score QOL-BREF, Total score of sleep hygiene awareness (SHAP), Total score of sleep hygiene practice (SHAP), nap duration, nap Frequency etc. The results indicated a significant correlation between the following factors and sleep disorders: Drink more than two teas or others, drinking green tea (OR = 0.1.841, 95% CI 1.220–2.777, P <0.05), SAS (OR = 1.047, 95% CI 1.015–1.081, P <0.05), GDS (OR = 0.912, 95% CI 0.867–0.960, P <0.001), ESS (OR = 1.064, 95% CI 1.032–1.097, P <0.001), AD8 (OR = 1.082, 95% CI,1.014–1.155, P <0.05)), score in physiological domain (OR = 0.699, 95% CI,0.637–0.767, P <0.001), score in environmental domain (OR = 1.238, 95% CI, 1.129–1.358, P <0.001), total score of sleep hygiene awareness (OR = 1.068, 95% CI, 1.042–1.094, P <0.001), and total score of sleep hygiene practice (OR = 1.014, 95% CI,1.002–1.026, P <0.05)), Nap duration=30-90 min (OR = 0.492, 95% CI, 0.340–0.713, P <0.001), Nap duration≥90 min (OR = 0.441, 95% CI 0.234–0.832, P <0.05).

Logistic Regression model analysis showed that tea drinking, anxiety, drowsiness, cognitive decline, surrounding environment, poor sleep hygiene awareness and habits were significantly associated with the increased risk of poor sleep (OR = 1.014 ~ 1.841,P<0.05), Of which Drinking green tea (OR = 1.841,95% CI, 1.220–2.777,P <0.05) has the strongest correlation with poor sleep; And a nap time of 30–90 minutes (OR = 0.492, 95% CI, 0.340–0.713, P <0.001), with a nap

Table 3 Results From Logistic Regression Screening for Factors Associated With Sleep Disorders in the Elderly (n=903)

Variable	*B*	*SE*	*Wald*	*Df*	*P*	*OR*	95% CI
History of drinking tea (NO)			9.066	3	0.028		
Green tea	0.610	0.210	8.459	1	0.004	1.841	1.220–2.777
Black tea	−0.174	0.695	0.063	1	0.802	0.840	0.215–3.283
Drink more than two teas or others	−0.136	0.461	0.087	1	0.768	0.873	0.354–2.155
Total SAS scores	0.046	0.016	8.008	1	0.005	1.047	1.014–1.081
Total GDS scores	−0.092	0.026	12.382	1	0.000	0.912	0.867–0.960
Total ESS scores	0.062	0.016	15.671	1	0.000	1.064	1.032–1.097
Total AD8 scores	0.079	0.033	5.708	1	0.017	1.082	1.014–1.155
Physiological domain (QOL-BREF)	−0.358	0.048	56.615	1	0.000	0.699	0.637–0.767
Environmental domain (QOL-BREF)	0.213	0.047	20.499	1	0.000	1.238	1.129–1.358
Total score of sleep hygiene awareness (SHAP)	0.066	0.013	27.137	1	0.000	1.068	1.042–1.094
Total score of sleep hygiene practice (SHAP)	0.014	0.006	5.598	1	0.018	1.014	1.002–1.026
Nap duration (minutes/day)							
No nap			18.417	3	0.000		
≤30 min	−0.032	0.242	0.018	1	0.893	0.968	0.602–1.556
30–90 min	−0.708	0.189	14.097	1	0.000	0.492	0.340–0.713
≥90 min	−0.818	0.324	6.386	1	0.012	0.441	0.234–0.832

Notes: Input variables: gender, age, years of education, marriage, chronic diseases, smoking history, drinking history, tea drinking history, exercise (each exercise for 20 minutes or more), SAS total score, GDS total score, ESS total score, AD8 total score, physiological total score QOL-BREF, psychological total score QOL-BREF, social relations field total score QOL-BREF, environmental total score QOL-BREF, Total score of sleep hygiene awareness (SHAP), Total score of sleep hygiene practice (SHAP), nap duration, nap Frequency.

time of 90 minutes (OR = 0.441,95% CI, 0.234–0.832), P <0.05) was significantly associated with a reduced risk of poor sleep.

Discussion

In this cross-sectional study, we observed that the prevalence rate of sleep disorders among the elderly in Wenzhou City, Zhejiang Province, in the Southeast Coastal Areas of China was 35%, a rate similar to the nationwide prevalence.[25] Females exhibited a higher prevalence rate of sleep disorders compared to males, a finding consistent with other studies.[26] Among the 7 sleep subdomains of the PSQI, the most common phenomenon observed was reduced sleep efficiency (38.8%), followed by difficulty falling asleep (29.6%) and sleep duration (27.5%), differing from the study results of the elderly in other provinces of China.[27] Across all subdomains of sleep disorders, females demonstrated a higher prevalence rate of poor subjective sleep quality and difficulty falling asleep compared to males, with a statistically significant difference noted in inter-group comparison. This disparity was attributed to factors such as personality characteristics, behavioral habits, hormone levels, and disease conditions among females.[28]

The relationship between sleep disorders in elderly individuals in this region and anxiety, depression, and other mental and psychological conditions was highlighted by this study. Previous research indicated a close association between sleep insufficiency and excessive anxiety, with the impact of sleep insufficiency on anxiety being linked to impaired activity in the medial prefrontal cortex and connectivity associated with expanded edge regions.[29] Additionally, there is evidence of a bidirectional relationship between sleep duration and depression: short sleep duration serves as a risk factor for the onset and recurrence of depression, while depression can lead to shortened sleep duration.[30] A study conducted with elderly individuals in Asia revealed that depression among the elderly was uniquely correlated with daytime dysfunction, while anxiety in the elderly was moderately associated with sleep perception.[31]

Afternoon naps are typically associated with night time sleep. Elderly people in the coastal cities of southeast China have the habit of napping, and the rate of this study was 44.9%. This study showed that compared with no nap, napping reduced the risk of poor sleep, especially the nap time over 30 minutes significantly reduced the probability of poor sleep, which is different from previous studies. Although some past studies have shown that Napping for less than 30 minutes during the day can help people feel more awake and improve performance and learning capacities. And, frequent and prolonged afternoon naps might be associated with higher incidence and mortality rates, especially among the elderly.[32] However, some studies suggest that napping can not only improve daytime sleepiness, but also improve memory consolidation, increase emotional stability, and improve nighttime sleep.[33] Napping can benefit athletes' physical state and cognitive performance, perceptual measures, mental state and night sleep, and suggested that 20–90 minutes of nap time is more conducive to their physical and mental state.[34] Taking a 15 - 59 - minute nap in pregnant women improves sleep efficiency and sleep quality that night;[35] However, in the elderly, although many studies suggest that the impact of napping on nighttime sleep and physical and mental state depends on the duration of the nap, and the nap time should not be too long. It is believed that a nap of less than 30 minutes has a lower risk of all-cause mortality, cardiovascular diseases and metabolic diseases.[9] But for the southeast coast most of the elderly they have at least ten years or decades of nap habits, and general nap time in more than half an hour, have a fixed nap time and frequency, they think that if not nap may affect the afternoon psychosomatic state and working state, can lead to physical and mental tired, that night will go to bed early, but the elderly usually sleep time is shorter, sleep fragmentation, this is more likely to lead to the elderly wake up early, thus affect sleep circadian rhythm, may also increase the risk of poor sleep at night. In a study in China, a nap of 60–90 minutes per day could promote the positive cycle of sleep time and health.[36] A nap duration of 30–60 minutes is a protective factor for simple reaction time, thereby improving neuropsychological functions such as sleep in the elderly.[37]

Our study also demonstrated that sleep disorders in the elderly were linked to their sleep hygiene awareness and practices. Engaging in healthy sleep behaviors can mitigate the negative effects of genetic predisposition and lifestyle factors on emotional risk.[38] Previous research has indicated that adopting healthy sleep behaviors can improve sleep quality to some extent. For instance, mindfulness meditation has been shown to enhance sleep quality and reduce daytime dysfunction in elderly individuals with sleep disorders.[39] Additionally, passive body heating through a warm shower or

bath before bedtime has been found to improve sleep quality and long-term Tai Chi exercise has been shown to mitigate age-related declines in sleep quality.[40,41]

It was demonstrated that sleep disorders in the elderly are linked to cognitive changes.[42] A previous study highlighted the interconnectedness of brain development, sleep, and cognition.[43] Sleep restriction was found to have a significant negative impact on cognitive processing.[44] Insufficient sleep could lead to the accumulation of amyloid-β (Aβ), initiating early cognitive decline and potentially progressing to Alzheimer's disease. In a study involving elderly individuals with mild cognitive impairment but no history of depression, sleep disorders were significantly correlated with the volume of the left hippocampus and amygdala, indicating a structural correlation between sleep disorders and cognition.[45] Another study also suggested that poorer working memory was associated with lower total sleep duration and sleep efficiency.[46]

A prospective cohort study conducted with the elderly revealed that Excessive Daytime Sleepiness (EDS) had adverse effects on dementia.[47] Sleep disturbances were prevalent and linked to increased daytime sleepiness, both of which were associated with a higher risk of ischemic vascular disease. Severe daytime sleepiness, in particular, emerged as a strong predictor of vascular dementia consequently leading to corresponding sleep issues.[48]

Our study suggests that tea drinking is a risk factor for increasing sleep disorders in the elderly. Although a study conducted in Japan supported this finding, indicating that daily consumption of low-caffeine green tea could enhance sleep quality in the elderly by mitigating stress.[49] But it is well known that tea contains caffeine, is a kind of excitatory substance, excessive caffeine drinking can cause insomnia.[50,51] In the current study, drinking tea is a risk factor of poor sleep in the elderly, in a 6173 elderly sleep quality status of tea and increase the prevalence of sleep disorders significantly associated.[51] While other studies also suggested that tea drinking is an independent influencing factor of poor sleep in the elderly.[13,52] And those who consumed more tea were significantly more likely to have sleep disorders and low mood.[53] One study used the analysis of sleep architecture to determine the wake-induced effect of green tea ethanol extract during chronic administration (three weeks). Throughout the treatment, green tea ethanol extract (1500 mg / kg) significantly increased the sleep latency and wakefulness, and long-term administration of green tea ethanol extract (1500 mg / kg) consistently increased wakefulness for up to 3 hours.[54]

Our research further supported the idea that sleep problems and QoL are correlated, with the physiological and environmental domains being the primary areas of effect. Quality of life (QoL) refers to a complex, multifaceted construct that is subject to several influences during its life cycle, one of which is the quality of one's sleep. According to a research by Peng et al, there is a substantial relationship between senior citizens' physical health and their quality of sleep in communal homes in Southern China.[55] According to a research by Zhou et al, there appears to be a stronger link between short-term exposure to air pollution and sleep disturbances in older adults.[56] Research by Kang et al more clearly shows the intuitive relationship between the subjective sleep quality and QoL in obstructive sleep apnea patients.[57]

This research was a population-based epidemiological study designed to aid health interventions and prevent sleep disorders among the elderly in this region. Several risk factors for sleep disorders in the elderly were identified, including being female, taking afternoon naps, drinking tea, experiencing anxiety, sleepiness, cognitive decline, and having poor sleep hygiene awareness and practices. Managing these factors could help improve sleep quality. Protective factors (eg taking afternoon naps and enhancing QoL in the physiological domain) were found to play a beneficial role in preventing sleep disorders. Among them, drinking green tea influence on poor sleep, and more than 30 minutes of nap time is beneficial to reduce the risk of poor sleep. In conclusion, it is recommended to develop targeted preventive measures and interventions for sleep disorders in the elderly. Training can be recommended for healthcare professionals on sleep disorders in the elderly, such as education of sleep hygiene knowledge, behavioral intervention of CBT for insomnia, to develop good sleep hygiene habits. At the same time, it is recommended to choose tea types and monitor tea consumption as part of the dietary assessment, as well as the appropriate nap time to reduce the risk of poor sleep in the elderly.

However, some limitations were present in this study. Potential bias from self-reported sleep data, such as recall bias or underreporting of sleep problems. As it was cross-sectional, establishing causality was not possible. Additionally, unmeasured confounding factors such as personality traits were not considered, which might have influenced the results. Lastly, Due to our objective conditions and the elderly are difficult to cooperate, there was a lack of objective assessments using polysomnography (PSG) for sleep disorders, which should be explored in future research. Perform

longitudinal studies to further explore the effects of appropriate nap time on sleep to guide intervention strategies for sleep hygiene. Along with the Long-term monitoring of wearable devices to measure sleep patterns and chronic disease risk was applied,[58] the 24-hour sleep assessment capabilities of contactless sleep technologies (CSTs)[59] to actigraphy in community-dwelling older adults. Potentially advancing the field of automated sleep assessment through efficient and user-friendly wearable monitoring systems.[60] These can be applied in future studies. Finally, since the scope of our study was limited to Wenzhou, Zhejiang Province, China, and the small sample size was small, a larger sample size is needed to validate our findings.

Conclusion

This study shows that gender differences, napping habits, tea-drinking behaviors and mental health status all have significant influences on sleep quality. Women are more likely to have sleep disorders compared with men. Moderate afternoon naps and healthy tea-drinking habits are helpful to improve sleep quality, while a good mental state is an important guarantee for maintaining high-quality sleep. This study not only reveals the current situation of sleep disorders among the elderly in this region and its related factors, but also provides a theoretical basis for formulating effective prevention and intervention measures in the future.

Abbreviations

PSQI, Pittsburgh Sleep Quality Index; SAS, Self-rating Anxiety Scale; GDS-15, 15-item Geriatric Depression Scale; ESS, Epworth Sleepiness Scale; AD8, As-dementia 8 Questionnaire; SHAP, Sleep Hygiene Awareness and Practice; WHOQOL-BREF, the World Health Organization Quality of Life-BREF.

Data Sharing Statement

All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

Ethics Approval and Consent to Participate

This study was conducted with approval from the Ethics Committee of Wenzhou Seventh People's Hospital. This study was conducted in accordance with the declaration of Helsinki. Written informed consent was obtained from all participants.

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Disclosure

The authors declare that they have no competing interests in this work.

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